DYNAMICRESPONSE PREDICTION OF STEEL FRAME STRUCTURE CONSIDERING SEMI-RIGID CONNECTION BY APPLYING DAMPER

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This project is dedicated to my lovely parents who have taken great point to see me prosper in life.

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ABSTRACT

In design stage, the conventional steel buildings are commonly using the methods of pinned design which means that the behavior of the connection is fully on the basis of pin and rigid design which means that the behavior of the connection is completely rigid. In contrast, the real behavior of joints are not fully rigid or fully pinned, therefore the discrepancy between these manners is called semi-rigid connection. Therefore, this study is lead to evaluate the semi-rigid connected frame under the dynamic loading by applying damper. The numerical method on the basis of stiffness matrix method, which is developed using in Matlab Program, is used to assess this condition that can be divided in the main five steps. Firstly, mass and stiffness matrixes of semi-rigid connection frame are obtained. Secondly, formulation of damping matrix is developed. Thirdly, solving the dynamic equation by central method. Fourthly, the changes of spring coefficient, natural frequency, damper frequency and damper ratio are considered. Finally, numerical method is verified by SAP 2000 modeling. In conclusion, by increasing the spring stiffness coefficient the lateral rigidity of frame increases. In the case of the constant section area of frame member, as the spring coefficient of semi-rigid increases while it reaches to rigid connection, the text increment of spring coefficient cannot improve rigidity of the frame. It means that there is no absolute rigid connection, and vice versa it is true for pinned connection. Other noticeable results are that, applying of damper and addition of damper ratio can dissipate vibration caused by dynamic loading in the shorter time and modify the amount of frame displacement at resonance frequency.

ABSTRAK

Pada peringkat reka bentuk, bangunan keluli konvensional biasanya menggunakan kaedah reka bentuk pin yang bermaksud bahawa kelakuan sambungan sepenuhnya adalah pin manakala reka bentuk tegar yang memberi maksud bahawa kelakuan sambungan adalah benar-benar tegar. Sebaliknya, tingkah laku sebenar sambungan adalah tidak tegar sepenuhnya atau pin sepenuhnya, oleh itu ia dipanggil sambungan separa tegar. Oleh itu kajian ini tertumpu kepada penilaian kerangka separa tegar yang berkaitan di bawah pembebanan dinamik dengan menggunakan peredam. Kaedah berangka berdasarkan kaedah matriks kekukuhan, yang diprogram menggunakan perision Matlab, digunakan untuk menilai keadaan ini yang boleh dibahagikan dalam lima langkah utama. Pertama,matrik jisim dan matrik kekukuhan separa tegar diperolehi. Kedua, pengiraan matrik redaman dilakukan. Ketiga, menyelesaikan persamaan dinamik dengan kaedah pusat. Keempat, perubahan pekali spring, kekerapan semula jadi, kekerapan peredam dan nisbah peredam akan dipertimbangkan. Akhir sekali, kaedah berangka disahkan melalui modelSAP 2000. Kesimpulannya, dengan meningkatkan pekali kekukuhan spring, ketegaran sisi kerangka bertambah. Dalam kes luas keratan lintang anggota kerangka adalah malar,dengan bertambah pekali spring separa tegar sehingga ia mencapai sambungan tegar, peningkatan pekali spring seterusnya tidak boleh meningkatkan ketegaran kerangka. Ia bermakna bahawa tidak ada sambungan tegar mutlak, dan ia juga berlaku untuk sambungan pin. Hasil lain yang ketara adalah penggunaan peredam dan penambahan nisbah peredam boleh melenyapkan getaran akibat daripada pembebanan dinamik dalam masa yang lebih singkat dan mengubah suai jumlah anjakan kerangka pada frekuensi resonan.